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Effect of combined feeding of cinnamon (*Cinnamomum verum*) and black cumin (*Nigella sativa*) powder on proximate composition and carcass characteristics of broiler chicken

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Abstract
The present study entitled "Effect of combined feeding of cinnamon (*Cinnamomum verum*) and black cumin (*Nigella sativa*) powder on proximate composition and carcass characteristics of broiler chicken" was conducted from June to July 2022 at Poultry farm of Animal Husbandry and Dairy Science section, College of Agriculture, Dhule (Maharashtra). One hundred broiler chicks were reared on a deep litter system for 42 days. Chicks were randomly distributed into four groups (i.e., 25 chicks in each group) with 4 treatment blocks and five replications. The control group (T_0) was without any dietary treatment, while combination of Cinnamon (CN) and Black cumin seed (BCS) powder was added in the experimental diets at the concentrations 0.30%, 0.75% and 1.0% each, for treatments T_1, T_2 and T_3, respectively. The results showed that the proximate composition of thigh meat showed a statistically significant difference in crude protein and crude fat among the different treatments. Whether moisture, dry matter, ash and nitrogen-free extract showed non-significant results between the treatments and the carcass characteristics data indicated non-significant differences among different treatments regarding dressing percentage, cut-up parts like breast, giblet, drumstick and thigh percentage also edible and non-edible percentage. The proximate composition of breast meat has shown that there were no significant differences among the treatments for moisture, dry matter, ash, crude protein, crude fat and nitrogen-free extract at 42 days of age.

Keywords: Combined feeding, cinnamon, black cumin, proximate composition, carcass characteristics, broiler

Introduction
Poultry is more prolific than any other type of livestock. Protein, vitamins, and minerals like iron, selenium, zinc and B vitamins are all present in sufficient quantity. Consequently, chicken flesh is regarded as a healthy meat. Broiler meat is the fastest developing section of global meat, India has been ranked eighth in meat production. Nowadays, consumers are becoming more aware of the nutritive value and safety of their food and its contents on a global scale. Antibiotics, probiotics, and prebiotics are used as feed additives in broiler diets for improving nutrient utilization through various mechanisms. The significance of using natural feed additives has increased, which are used as an alternative to replacing the potential risk and disadvantages of employing antibiotics growth promoters (AGP) in the diet of broilers. Herbal products are used as growth promoters and act as a booster to enhance feed intake, weight gain, decrease mortality and increase FCR (Briminkmeryer, 1996) [5].
Cinnamon is scientifically known as *Cinnamomum verum*. It is commonly called as "Dalchini" in India. It is a member of the Lauraceae family. Its origin is in Sri Lanka and South India (Jakhetia *et al.,* 2010) [12]. Cinnamon is derived from the bark of a cinnamon tree. Cinnamon bark may be found significant as a phytogenic feed additive in the starter feed of broiler because it contains numerous essential oils, including cinnamic acid, cinnamate, cinnamaldehyde, eugenol, caryophyllene oxide, camphor, plenty of water, fat-soluble vitamins and also consists of carbohydrates, proteins, fats, a considerable amount of minerals (Tung *et al.,* 2008) [19]. Cinnamaldehyde acquires antibacterial properties (Chang *et al.,* 2001) [7], antioxidantal properties and different medicinal properties like anti-ulcer, anti-inflammation, anti-diabetic and anti-hypercholesterolemic effects (Jakhetia *et al.,* 2010) [12]. Cinnamon contains various aromatic phytochemicals, it is used to cover the unpleasant taste of other substances (Faix *et al.,* 2009) [8].

Black cumin seeds have a botanical name "*Nigella sativa*" also known as Kalonji, black seed, black caraway seed, Roman coriander, kalonji and fennel flower, it is an annual flowering herb of the Ranunculus (Ranunculaceae) family. It has been widely utilized as a food or medicine for more than two thousand years throughout the world. It is a natural feed used in a diet of chicken. Black cumin seeds (BCS) are diversely benefited for digestion, appetite and as an immunity booster. It has antibacterial and antioxidant properties. It is bitter in taste. BCS has various pharmacologically active compounds such as thymoquinone, Di thymoquinone, thymol, carvacrol, nigellicine-N-oxide and nigellidine. Additionally, BCS is enriched with a 35.5% fat content. Currently, scientists are aiming to enhance livestock growth rates and feed efficiency by employing helpful herbs and some therapeutic plant seeds, including black cumin (Guler *et al.*, 2006) [11]. The main objective of this paper was to find out the effects of combined feeding of cinnamon and black cumin on the meat quality of chicken.

Material and Methods

The present investigation was conducted from 16th June to 28th July 2022, at poultry farm of the department of Animal Husbandry and Dairy Science, College of Agriculture, Dhule, (MS) India. One hundred day-old (Vencobb-400) broiler chicks were purchased from Sakshi Poultry, Dhule (Rajdhani Agro-products) for the current study. All the experimental chicks were individually weighed. Thereafter, chicks were randomly distributed into four treatment groups: T_0, T_1, T_2 and T_3, with 25 chicks in each treatment group, on equal weight basis. The following are treatment details:

Table 1: Details of Dietary Treatments and Feedings

Treatment	Treatment details
T_0	Basal diet without black cumin and Cinnamon powder
T_1	Basal diet + Cinnamon powder + Black cumin seed powder @0.30% each
T_2	Basal diet + Cinnamon powder + Black cumin seed Powder @0.75% each
T_3	Cinnamon powder + Black cumin seed Powder @1% each

During the experimental period, proximate analysis of cinnamon and black cumin powder and proximate analysis of meat was carried out using the standard procedure of AOAC (1990) [2] and AOAC (2005) [3]. The birds were slaughtered at the end of 6th week of age. In the proximate composition of breast and thigh meat, moisture was determined as per the standard procedure of AOAC (1990) [2]. Whereas, dry matter, total ash, crude protein, ether extract, crude fiber and Nitrogen-free extract (NFE) was determined as per the standard procedure of AOAC (2005) [3]. Following are the formulae for calculation, Moisture was calculated as follows:

$$\text{Moisture (\%)} = \frac{\text{Fresh weight (g)} - \text{Dry weight (g)}}{\text{Fresh weight (g)}} \times 100$$

Dry matter was calculated as follows:

$$\text{Dry matter (\%)} = \frac{b}{a} \times 100$$

Where,
a = Fresh weight of the sample (g)
b = Dry weight of the sample (g)

Total ash content was calculated as follows:

$$\text{Total ash (\%)} = \frac{a - b}{c} \times 100$$

Where,
a = Weight of silica crucible with ash (g)
b = Weight of empty silica crucible (g)
c = Weight of dry sample taken for ash (g)

The ether extract was calculated as follows:

$$\text{Total ash (\%)} = \frac{a - b}{c} \times 100$$

Where,
a = Initial weight of extraction cups (g)
b = Weight of samples on DM basis (g)
c = Weight of extraction cups with ether extract (g)

The crude fiber was calculated follows:

$$\text{Crude fiber (\%)} = \frac{b - c}{a} \times 100$$

Where,
a = weight of sample on DM basis (g)
b = weight of crucible with fiber (g)
c = weight of crucible with ash

The nitrogen-free extract was estimated as follows:

%NFE= 100- (%EE + % CP + % Ash + % CF)

Carcass Characteristics

Carcass traits were evaluated after slaughtering, dressing and evisceration of birds. Five birds from each treatment were slaughtered at the end of the experiment to study carcass characteristics. Live weight was recorded prior to the slaughter of birds.

Dressing Percentage

The dressing percentage is calculated as follows:

$$\text{Dressing percentage} = \frac{\text{Carcass weight}}{\text{Final body weight}} \times 100$$

Weight of Liver and Other Organs
Different cut-up parts of the carcass were weighed, including the breast, thigh, drumstick, heart, gizzard and liver.

Live Weight
Birds were weighed before slaughtering using an electronic balance.

Dressed weight.
After slaughtering, the dressed birds were weighed and dressed weight was calculated as follows:

$$\text{Dressed weight (g)} = \frac{\text{Weight of dressed bird (g)}}{\text{Live weight of the bird (g)}}$$

Eviscerated Weight
Weight of carcass along with giblets and skin.

$$\text{Eviscerated weight (g)} = \frac{\text{Eviscerated weight (g)}}{\text{Live weight of bird (g)}}$$

Edible Weight

$$\text{Edible weight (g)} = \frac{\text{Edible weight (g)}}{\text{Live weight of bird (g)}}$$

Giblet Weight
Weight of heart, liver and gizzard.

$$\text{Giblet weight (g)} = \frac{\text{Giblet weight (g)}}{\text{Live weight of bird (g)}}$$

Statistical Analysis
The data collected throughout the trial were statistically analyzed by Completely Randomized Design (CRD) given by Snedecor and Cochran (1994) [17].

Results and Discussion
Proximate composition of experimental broiler ration
It was observed that the broiler ration involved adequate nutrients for the growth of chicks during the experimental period, was observed as per BIS (2007) [6]. The proximate composition of the experimental pre-starter, starter and finisher was estimated. The pre-starter ration contained crude protein, crude fiber, ether extract, total ash and NFE are 22.85%, 5.02%, 3.35%, 5.47% and 63.31%, respectively. The starter ration contained crude protein, crude fiber, ether extract, total ash and NFE are 22.58%, 4.06%, 3.58%, 6.6% and 63.18%, respectively. The finisher ration contained crude protein, crude fiber, ether extract, total ash and NFE of 20.32%, 5.21%, 3.96%, 5.30% and 65.21%, respectively.

Proximate Analysis of Cinnamon and Black Cumin
The proximate composition of cinnamon bark powder contained crude protein, crude fiber, ether extract, total ash and NFE of 3.85%, 44.09%, 1.76%, 4.21% and 46.09%, respectively. The observations are similar to the findings of Gaikwad *et al.*, (2018) [10] who investigated the proximate composition of experimental feed additives i.e., Cinnamon on a dry matter basis.
The proximate composition of experimental black cumin seed powder contained crude protein, crude fiber, ether extract, total ash and NFE is 19.02%, 7.30%, 14.23%, 4.17% and 55.28%, respectively. The observations are similar to the findings of Sharma *et al*., (2021) [16] who conducted an experiment on the nutritional evolution of Black cumin seed powder as phytogenic feed additive.

Proximate Composition of Breast Meat
The effect of the dietary inclusion of cinnamon and black cumin powder on meat composition in breast muscle is presented in Table 2. The difference in proximate composition of breast meat was statistically non-significant among all treatment groups T_0, T_1, T_2 and T_3, which indicated that, although the different levels of combination of Cinnamon and Black cumin powder in diet improved feed conversion efficiency but the meat quality was unaffected. The results of this study was similar to Gaikwad *et al.*, (2018) [10] who reported that the differences in proximate composition of breast muscle of broiler meat were non-significant with the supplementation of ginger and cinnamon among different treatments and control group. Asghar *et al.*, (2022) [4] who reported a non-significant effect in ether extract and ash on the proximate composition of breast meat supplementing black cumin seeds in Japanese Quails.

Proximate Composition of Thigh Meat
The effect of the dietary inclusion of cinnamon and black cumin powder on meat composition in thigh muscle is presented in Table 3. The crude protein and fat content of thigh muscle was found to be statistically significant among all the treatments fed with diet of cinnamon and black cumin. The difference in moisture, dry matter, ash and NFE among all treatment groups T_0, T_1, T_2 and T_3 was found to be statistically non-significant. The results of this study was similar to the analysis of Gaikwad *et al.*, (2019) [9] who reported that the difference observed in the crude protein of thigh muscle was significant ($P<0.05$) with the supplementation of ginger and cinnamon among different treatments and control group. Rahman and Kim (2016) [15] reported a non-significant difference in the proximate composition of chicken thigh muscle in moisture and ash content among different treatment groups fed with dietary *Nigella sativa* seed supplementation but the NSS powder resulted in a significant ($p<0.05$) increase in crude protein content and crude fat content relative to the control group. Also, Asghar *et al.*, (2022) [4] reported that, a significant difference among the treatments in the crude protein of proximate composition of thigh meat by supplementing Black cumin seeds in Japanese Quails.

Carcass Traits
Data on carcass traits (%) due to different dietary treatments of cinnamon and black cumin during the experimental period are represented in Table 4. The carcass characteristics data indicated a statistically non-significant difference in carcass traits (%) among the different treatment groups. The breast yield was highest in the treatment T_2 group. Giblet (%) was observed higher in treatment T_2. Although, slight variation was observed in drumstick and thigh percent of carcass weights of different treatment groups. However, the

difference among all the treatments was non-significant. The results were in line with the reports of Symeon *et al.*, (2014) [18], Koochaksaraie *et al.*, (2011) [14], who reported a non-significant difference in carcass trait due to feed supplementation with cinnamon powder at varying concentrations.

Jha *et al.*, (2014) [13], Al-Beitawi and El-Ghousein (2008) [1] who reported a non-significant difference in any of carcass characteristics due to the inclusion of Black cumin in feed at different levels.

Table 2: Proximate composition of breast meat in different treatments by feeding combination of cinnamon powder and black cumin powder

Parameter	Treatments				SE (±)	CD@5%
	T0	T1	T2	T3		
Moisture	71.39	71.67	71.44	71.58	3.10	NS
DM	28.61	28.33	28.56	28.42	1.23	NS
Ash	1.27	1.24	1.20	1.17	0.053	NS
Crude Protein	19.51	22.40	23.19	22.79	0.85	NS
Crude Fat	3.28	3.42	3.33	3.34	0.14	NS
NFE	75.94	75.52	75.85	76.0	3.28	NS

NS- Non-significant
DM- Dry matter
NFE- Nitrogen-free extract

Table 3: Proximate composition of thigh meat in different treatments by feeding combination of cinnamon and black cumin powder

Parameter	Treatments				SE (±)	CD@5%
	T0	T1	T2	T3		
Moisture	68.75	67.33	68.81	68.79	2.95	NS
DM	31.25	32.67	31.19	31.21	1.37	NS
Ash	1.28	1.34	1.36	1.29	0.057	NS
Crude Protein	19.22^{b}	19.43^{b}	20.40^{a}	19.86^{ab}	0.24	0.73
Crude Fat	2.16^{c}	2.77^{b}	3.14^{a}	2.81^{ab}	0.12	0.36
NFE	77.34	76.46	75.1	76.04	3.30	NS

Table 4: Effect of feeding different levels of combination of cinnamon & black cumin powder on carcass traits of broilers

Carcass Traits (%)	Treatments				SE (±)	CD @5%
	T0	T1	T2	T3		
Live body weight	2109.21	2118.52	2158.43	2139.47	92.40	NS
Breast (%)	26.15	26.62	27.83	27.07	0.14	NS
Giblet (%)	4.75	4.89	4.72	4.81	0.22	NS
Drumstick (%)	23.76	24.08	24.31	24.11	1.04	NS
Thigh (%)	15.21	15.32	16.12	16.03	0.68	NS
Edible (%)	64.72	64.86	65.23	64.37	2.80	NS
Non-Edible (%)	35.28	35.14	34.77	35.63	1.53	NS
Dressed Weight	1599.11	1600.22	1637.72	1617.11	69.88	NS
Dressing (%)	75.81	75.53	75.87	75.58	3.28	NS

SE- Standard Error
CD- Critical Difference

Conclusion

It is concluded that the effect of a combined feeding of cinnamon and black cumin powder in the diet at different levels on the proximate composition of thigh meat containing crude protein and fat was found to be statistically significant. Whereas moisture, dry matter, ash and NFE found to be non-significant among the different treatment groups. The carcass characteristics and the proximate composition of breast meat containing moisture, dry matter, ash, crude protein, crude fat and nitrogen-free extract had a non-significant effect in different treatments.

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